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Blister-Rust Control

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OBSERVATIONS ON THE MANAGEMENT OF WHITE PINE WITH SPECIAL  
REFERENCE TO REPRODUCTION METHODS USED ON THE HARVARD  
FOREST AT PETERSHAM, MASSACHUSETTS. \*

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The ease with which white pine reproduction may be secured varies greatly with the character of the soil. Of the many factors, climatic and edaphic, influencing the timber growing ability of a given location none has so great an effect on the reproduction of pine as the character and composition of the soil and the resulting soil moisture conditions.

On what has often been called, "natural pine land" namely, dry to fresh sandy or gravelly soils, the reproduction of pine stands is relatively simple. Any one of several standard methods of management may accomplish the desired result. Perhaps the most widely known is that of leaving a few (3-10) heavy-crowned wind-firm trees per acre, evenly distributed, or in groups. If on narrow strips or in small groups all the trees are removed a good reproduction of pine often results. In 1913-1914 at Petersham an area of pine was clear cut and no advanced growth (small pines under the merchantable trees) being present planting was thought to be necessary. Accordingly, as an experiment, spruces were set out on the area. A few years later there were large numbers of small but very thrifty white pines (many more than were needed for future pine stand) on the southern portion. Their origin was obviously seed blown from trees on the edge of the cutting. The explanation of their thrifty condition was the lack of vigorous hardwood competition and an examination of the soil showed the southern portion to be rapidly draining gravel esker, - sufficient explanation for the comparatively slow growth of hardwood. In the case of another clear cut area, made several years previous, on which it was hoped there might be good reproduction of pine from heavy-crowned, thrifty trees on the margin of the cutting there is not a single seedling available for the new crop. Undoubtedly more pine seed fell on this second area, subsequent to the cutting, than on the first area. The explanation of the lack of pines in the new crop lies in the fact that the soil, which is deep, rich and fertile, caused a rank growth of hardwood sprouts too dense for the survival of pine seedlings. Where small groups of merchantable trees with intermediate groups of young

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the same time, the number of people who are able to work has declined sharply. The result is that the economy is producing less than it could, and the government is spending more than it takes in.

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• *Chlorophyll a* (Chl a) is the primary photosynthetic pigment in most plants and algae. It is a green pigment that absorbs light energy in the blue and red regions of the visible spectrum. Chl a is essential for the light-dependent reactions of photosynthesis, where it converts light energy into chemical energy in the form of ATP and NADPH.

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growth occur on "natural pine land" the plan of cutting the mature groups, leaving clumps of near-mERCHANTABLE trees, which will seed-in the area, is likely to give satisfactory results, due primarily to the lack of hardwood competition on this class of soils. Clear cutting a pine stand in the winter following a heavy fall of seed often results in abundant pine reproduction.

Due to the abandonment of farms which started at the time of the Civil War and was augmented by the development of manufacturing on the waterpower sites along the railroads, and to the opening up of the West, many of the present mature and nearly mature pine stands are on areas not naturally pine land. The presence of open-grown, isolated pines in pastures and along the road sides, furnishing seed relatively light and easily carried by the wind, is responsible for the establishment of pine rather than oak, cherry, basswood and chestnut on abandoned land favorable to the growth of hardwood. These same hardwood species appear as advanced growth under the pine stands when, after it reaches forty-five years of age, the crown canopy opens up to some extent, admitting more light to the forest floor.

A large percentage of the area of the Harvard Forest is natural hardwood land where, as nearly as we can determine, the primeval forest was composed of hardwood trees with only here and there a veteran pine rearing its head above the general level of the forest canopy. Indications are that if left to herself nature would gradually restore this condition, the climax forest. Because of the demand for softwood lumber, white pine in particular, our present great problem is to secure pine reproduction where hardwood is nature's choice. Opposing nature is expensive. Any method of reproducing pine on hardwood land costs money. The choice of method often depends on the relative cost which is generally less if the more valuable portion of the natural hardwood reproduction is accepted with an attempt thru management to secure with this a goodly portion of pine, using the mixed forest of pine and hardwood in favor of which there are several arguments. It is generally accepted that the highest quality of second growth pine lumber comes from mixed stands. Furthermore, in the case of mixed stands no one pest such as the blister rust is likely to kill the entire crop. Growing large areas of a single species is, "putting all the eggs in one basket", the destruction of the chestnut by blight, of Larch by the sawfly, and of spruce by the budworm are examples of the possible disastrous results. The growing of pure white pine in large blocks might greatly reduce the cost of protecting against blister rust, but I doubt whether it would be a wise policy.

During the course of his twelve years of work at Petersham, Professor Fisher has developed a method of securing a large proportion of pine in mixture with the hardwood reproduction on the more fertile soils. It consists in removing the mature stand in two cuts with a subsequent weeding of the new crop. The first cut is made from five to seven years before the age determined





for the complete removal of the stand. This removes, in addition to all of the dead any dying trees, a sufficient number of the dominant to materially open up the crown canopy, giving the remaining trees an opportunity to extend their crowns. A stimulation of seed production results. The partial decomposition of the needle litter of the forest floor brought about by increased light, makes a more favorable seed bed. The two or three seed years, which will occur during the seven years that elapse before the final or clear cutting of the area, produce an abundant advance growth of pine seedlings not less than 5,000 and, under favorable conditions, sometimes 25,000 per acre. The final cutting, which takes all of the remaining trees, is best made on snow to avoid excessive damage to reproduction. If, as is usually the case, there is an abundance of young hardwood growth with the pine seedlings under the mature stand, this is cut back almost to the ground with a bush-scythe before the final cutting is made, in order to give the pine a better start in competition with the hardwood. Care must be taken not to cut too low, thus moving off the tops of the young pines. The cost is more than justified by the saving of the choppers' time as they habitually cut the underbrush near a tree preparatory to felling it.

Brush burning is essential if the entire growing capacity of the area is to be utilized for the new crop as the windrows of brush occupy at least 30% of the area after a logging operation. Occasionally brush burning may be carried on during the logging by keeping fires going near the choppers. More often the slash is not disposed of at the time of logging but is burned in small piles as soon as weather conditions are favorable in the Spring. The cost ranges from 15¢ to 70¢ per thousand feet of logs cut. The more dense the stand the less the volume of slash per thousand feet, and the cheaper the cost of burning. 30¢ per thousand may be considered an average figure for fairly dense stands. This is a cost to be charged against the new crop.

The other costs are those incurred in weeding during the first ten years. The hardwood sprouts grow much more rapidly than pine seedlings and if undisturbed would soon choke them out. Certainly two, and often three, weedings are necessary to insure the pines a permanent place in the new crop. These weedings or cleanings consist in cutting back the more vigorous hardwoods, freeing the thrifty pines. Only those hardwoods, which shade pines, need be cut. It is much better to cut partly through the hardwood stems, at a convenient height above the ground lopping them over to die slowly from lack of light, than to completely sever the stems near the ground, which results in a vigorous sprout. If the method of lopping is practiced, the cost is less and the effect more lasting. When logging operations are carried on annually, as at Petersham, the necessity of removing the crop in two cuttings entails little or no additional expense.

The costs of the new crop are the expense of brush burning and the charges for weeding, together amounting to from \$10.00 to \$18.00 per acre. In the case of isolated wood lots economic necessity often requires that the entire stand be removed at one cutting. Where this is necessary brush burning and planting may be substituted for the method outlined above. When planting stock is available at moderate cost, as from State Forest Nurseries, the cost of planting is not prohibitive. An insect pest, the Hylobius Beetle, is





injurious to stock planted on freshly cut-over pine land. Attracted by the smell of pitch these beetles migrate to the cutting area in the Spring immediately following logging and breed in the stumps. They feed on the tender bark of small pines. After two Summers, when the pine stumps become dry and are no longer favorable breeding places, the beetles disappear. The natural pine reproduction resulting from the two-cut system is so abundant that even after the beetles have eaten their fill, killing as high as 60% of the seedlings, there are more than enough left. In planting an area, however, it is best to wait two years until the beetles have gone. By this time the hardwood advance growth will be well started and the more valuable species can be easily recognized. Comparatively few - 400 to 600 - pines per acre planted in the most favorable spots, where the hardwood growth is thin or of poor species, will establish the same kind of a mixed stand as is obtained by natural reproduction. The process and cost of weeding the planted area are about the same as given above for the two-cut system.

